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SPHINX VESPIFORMIS:

AN ESSAY

BY

EDWARD NEWMAN.

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"All are but parts of one stupendous whole,
Whose body Nature is, and God the soul."



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TO

HIS HIGHLY-ESTEEMED FRIEND,

BRACY CLARK, ESQ.

FELLOW OF THE LINNÆAN SOCIETY OF LONDON,

MEMBER OF THE ROYAL INSTITUTE

OF FRANCE,

&c. &c.

THIS LITTLE ESSAY

IS

DEDICATED

BY

THE AUTHOR.

P R E F A C E.

THE question—What was the Sphinx Vespiformis of Linnæus?—is one that has occurred to almost every entomologist. It seemed rather strange that Linnæus should have described, in all his works, an insect which had no existence; yet that really appeared to be the case. Laspeyres, the clever monographer of the *European Sesia*, previously to the appearance of that work, wrote to my highly valued and ingenious friend, Mr. Clark, requesting that he would investigate and describe for him the real Linnæan specimen of Vespiformis which was in the Linnæan cabinet, at that time in the possession of the late Sir J. E. Smith. Mr. Clark not only described the specimen in question, but employed that excellent artist, Sydenham Edwards, to make a drawing of it, which was forthwith forwarded to Berlin. Laspeyres exclaims—“*Sed quod spectaculum!—Sesia asiliformis erat.*”^{*} This was too

^{*} *Sesie* Europæ, p. 18. Obser.

much to believe; the search was given up as hopeless, and the existence of the Linnæan Vespiformis was pretty much considered a fable. On making some inquiries, a few months back, about the species of *Ægeria*, the total loss of one out of the three Linnæan species appeared a little unaccountable; and seeing the name of my friend in Laspeyres' work, in the note above referred to, I determined to have recourse to him, as the best authority on the subject. Mr. Clark, with the greatest kindness, at once accompanied me to pay a visit to the said Sphinx, now in possession of the Linnæan Society: we instantly, on seeing it, fell in with the decision of Laspeyres—" *Sesia asiliformis erat*;" yet it agreed excellently with the character which Linnæus had assigned to Vespiformis: " *Alis fenestratis; abdomine barbato nigro; incisuris tribus posterioribus margine flavis: capite annulo flavo.*"*—No character could be more correct; the specimen was labelled in the handwriting of Linnæus, and the fenestrated wings merely arose from the specimen being exceedingly wasted. The fact was decided: the proof is open to all; and the existence of Sphinx Vespiformis must henceforth cease to be a fable.

To ascertain the place among insects, or even animated beings, which this Sphinx Vespiformis naturally occupies, I have attempted in the following pages.

* Linn. Syst. Nat. T. I. Pars. II. p. 804.

The *SYSTEMA NATURÆ* has for years been the object of my most diligent search; but the idea which I have here taken of the subject is scarcely a month old. An anxiety to hear the opinions of others has urged me to scribble these few pages, with, I fear, far more haste than good speed; for it has happened that other engagements have prevented my affording them any time but that usually devoted to repose: so that the rapid and careless manner in which the sketch has been drawn, must be my apology for the very imperfect state in which I now offer it to the public. I feel, however, a firm conviction that my theory is too near an approach to truth, to suffer from any garb, however slovenly, in which I may have dressed it.

I must for the same reason here observe, that I will in no way pledge myself to the infallibility of the precise points of contact hereafter proposed, nor shall I notice any attempts which may be made to invalidate the principle of my theory, by appealing to such trivial inaccuracies. Feeble efforts of this kind are naturally and very excusably called forth by a feeling of disappointment at the sudden destruction of favourite and long-cherished theories: skillfully managed, they often throw a momentary shade over truth, but never can extinguish it; he, therefore, who is confident in having truth on his side, would be acting ungenerously to quarrel with them.

To conclude—for many excellent suggestions, and the kind and continued interest which he has taken in the progress of this little Essay, I embrace this opportunity of publicly acknowledging my sincere thanks to my esteemed friend, Mr. Edward Doubleday; feeling, however, that such thanks are a very inadequate return for his invaluable assistance.

DEPTFORD,

January 25, 1832.

ERRATA.

- Page 14, line 27, *for* I will suppose them, *read* I will suppose, then,
41, 6, *for* Lasciocampa, *read* Lasiocampa
41, 23, *for* of each, *read* on each
42, 4, *delete* previously
44, *note, for* Lithosia, *read* Lithosiæ
52, line 33, *for* Phalænæ, *read* Phalæna
52, 38, *for* kaned, *read* naked



SPHINX VESPIFORMIS.

&c.



ON THE PRIMARY DIVISION OF NATURE.

ANY attempt to overthrow existing systems, originally devised and unanimously approved by men of superior talents and great acquirements, should not only be made but received with the greatest possible caution ; but when, as in the arrangement of the objects of natural history, there exists no universally received plan, but each systematist has, for a few months, or at most, years, his little circle of immediate followers and admirers, one thing must be obvious,—that the true system is yet undiscovered ; and, therefore, surely it is competent to every one, however unqualified, to try his hand at the task : that the true system has not been discovered, is admitted by Mr. MacLeay, the only individual who has made any thing like an approach to it ; for, in the preface to the *Annulosa Javanica*, which appeared subsequently to the *Horæ Entomologicæ*, in which his circular and quinary system is proposed, he acknowledges, that, “ as yet, we have not even arrived at the threshold of nature’s temple.”

Some individuals would, I believe, argue that no fixed system or plan prevails in nature, but that each individual species exists quite independently of, and unconnected with all the rest ; others, again, allow that there is a system, but without any other division than that of species ; thus theoretically disallowing those plain and universally intelligible groups, which we term beasts, birds, fishes, and insects. It seems to me highly improbable that a Creator,

who has, with such unerring wisdom, adapted means to their destined ends, should have performed any part of the mighty work of creation without a fixed and perfect design. If we consider that no muscle, tendon, or vein, however minute, whether in man, the highest, or in those animals which may be reckoned the lowest grade among created beings, but has functions appointed for it regularly to perform, and that no single portion of our frame can be parted with, without occasioning us inconvenience, it seems fair to infer, that no single atom, or no one created thing, exists without filling some appointed place in a great and perfectly organized and arranged whole; however far that whole may, and must be, above our limited understandings. To doubt the existence of a natural system appears to me to be precisely equivalent to doubting a creation; for one cannot conceive the various tribes of animals to have received their being at the hands of an Omnipotent Creator, and yet to be indebted, at the same time, to chance for those gradual shades of difference from each other, which are found so harmoniously blending group into group, that the practised naturalist may follow up the same peculiarity of habit or structure, however varied in its development, from one to the other of the most opposite beings which you can place before him. Infinitely varied, however, as the course of such a peculiarity must be, the naturalist never finds those sudden departures from the regular flow of variation, which all systems, even the most approved, are constantly exhibiting; the reason of which is, that, in thus tracing approaches in his mind, he will continually discover an individual completely surrounded by others, each of which partakes of its peculiarities, not only in a different degree, but in a different mode; and thus he will perceive the character on which his attention has been fixed, ramifying in all directions. Now no system, hitherto suggested, will at all cope with this; it has been the plan, and I imagine the fault of all our systems, that they are so constructed as to be incapable of receiving a character from, or imparting it to, more than a single individual: hence they never can possess capacity sufficient to exhibit those endless chains of relation which the mind so luxuriates in tracing. The want of such a system has been, I believe, universally acknowledged, and should my humble

endeavour even prepare the way for its establishment, and act the mere part of a herald to proclaim its approach, I shall not only be satisfied, but delighted.

I cannot here plough my toilsome track through the wild waste of systems and speculations which have embarrassed, rather than assisted, natural history during the last hundred years; my aim will be more to make myself understood than comment on the merits of others, except as I can lay them under contribution to enhance my own.

Previously to the publication of Mr. MacLeay's *Horæ Entomologicæ*, it appears to have been an opinion universally prevalent, that there existed in nature a regularly graduated scale of beings, beginning with man as the most perfect, and terminating in the least perfect creature known to possess life. One ingenious author had varied a little from this theory by allowing a double series to nature's works, which commencing on a level with the most perfect animal and most perfect plant, descended gradually and approached as they descended, until they met in those jelly-like substances which seem yet to hover between the two kingdoms, puzzling naturalists by their proximity to both—the system thus assuming the shape of the letter V.*

However convenient for the formation of a catalogue, or the arrangement of a cabinet, such a system may be; and however inconvenient or impracticable any other conceivable plan may appear, I think few will concur in imagining man capable of, or warranted in, thus setting up limits and boundary-marks to the works and power of his Maker; for the next step, as a matter of course, would be the application of similar restrictions to infinite space, which he might as reasonably expect to bring under his sapient admeasurement.

Our country has the credit of having first sapped the foundation of a building, which, though by its founder† termed a commodious and well covered house, could not retain religion or reason among its inmates; indeed, the illustrious Swede was himself the first to see and to know that his mansion, however commodious, was built but on the sand; but knowing its imperfections, he cared

* The system of Lamarck.

† Linnæus.

not to alter them : he thought it enough to acknowledge without striving to amend them ; in fact, he really seems to have considered the natural system, like the philosopher's stone, a mere *ens imaginationis*, the pursuit of which would be but a waste of time : he doubted not its existence, but he doubted man's ability to discover it.

Such was natural history when Mr. MacLeay's immortal work first diffused its splendour over the world. The power of thought, the profound research which he there exhibited, and the confession that " he was one of those who preferred an imperfect transitory glimpse of nature pure and unveiled, to a full view of the most commodious and ostentatious mantle that could be employed to conceal her features from the gaze,"* were such novelties in the science, that men scarcely credited their understandings : they began thinking, and have continued to think until the term naturalist is not, as it was but a short time back, immeasurably separated from that of philosopher. The extraordinary merit of the *Horæ Entomologicæ* consists, not merely in disclosing and elucidating the invaluable fact, that a series of affinities, naturally arranged, has a constant tendency to describe a circle which eventually returns into itself : a still more important feature of the work is, that unceasing and determined endeavour evinced by its learned author to seek after, weigh, and examine facts, and to employ these alone in the support of his theories,—an endeavour indicative of that only true spirit of philosophy which has and can have no other end in view than the establishment of truth.

That I suppose Mr. MacLeay to have mistaken the number which nature has adopted in the combination and distribution of her various tribes—that I totally dissent from his idea of analogies and affinities, and from his division or rather adoption of Clairville's division of insects into mandibulate and haustellate, will be sufficiently evident from the contents of this little Essay ; but in these and all other instances, in which I feel myself bound to disclose any difference of opinion which may tend to reveal or establish truth, I hope I shall always be found urging my objections with the deference due to an author from whose works I have extracted

* *Horæ Entomologicæ*, preface, p. xxiv.

many important facts, and the still more important discovery which forms the ground-work of my own theory.

That nature has a decided tendency to the formation of circles, I cannot for one moment doubt. If there be yet doubters on that subject,—if there be yet those who deem the discovery of Mr. MacLeay a mere invention of his own, let them consider the plan of the universe, as established by the celebrated Newton,—let them behold the glorious sun, a circular centre of light and life; let them observe the circular attendant worlds, which revolve in circles about him, and which are themselves attended by circular moons, whose progression is still in circles: the very days of the year, a varied effect of the same universally operating cause, proclaim the existence of a circle, by lengthening and shortening until they arrive at the very day from which our observations began. These facts, these unquestionable facts, while they beautifully illustrate the existence of circles in the grand primary distribution of nature, point quite as decidedly to another conclusion, which it is my aim also to establish—that there is a tendency universally developed, in a greater or less degree, in all minor or less important circles to arrange themselves round major or more important ones. Systematists, although fully allowing the existence of this tendency in this the primary or highest system of nature which human intellect has hitherto been able to grasp; yet its application in detail to the systematic arrangement of the numerous objects of natural history has hitherto been totally neglected. It can hardly be supposed that the idea has never occurred to any of the illustrious writers who have devoted their time and talents to this interesting subject: it has most probably occurred, and been rejected as insupportable. It may perhaps be, that the apparent difficulty of arranging the objects of natural history thus, as it were, in a mass, has operated somewhat against the proposal or adoption of a plan like the present; but if we come to consider the question with the cool deliberation which an inquiry of this kind requires, I trust it will be generally considered that our first object is to discover, if possible, nature's plan; our second to adapt it to our own artificial ideas. Should the present, or any future scheme, prove incontrovertible,—and incontrovertible the real system of nature must be, whenever

discovered,—it will then be high time to meditate on the best plan of rendering it serviceable to ourselves, and available to science; and objectors on this score must please to recollect that the calculations for eclipses, and other important astronomical phenomena, experienced any thing but delay or difficulty from Newton's development of the true solar system. Be the system of nature discovered when it may, it will never be found that *Appia Via* which Linnæus has made it out to be, but rather like the Cretan labyrinth, and whoever may happen to be the fortunate Theseus, must undertake the task of showing the way to his competitors, until it becomes so well known, that a map of the road* may be drawn for the use of all.

It being then incontrovertibly established, that nature possesses, on the grand scale, two tendencies; one, the formation of globes or circles, the other, the disposition of inferior creations to cluster round superior ones, is it too great a presumption to imagine tendencies thus exhibited in the creation and government of worlds, as in some degree typical of the design from which universal nature has been modelled? Is there the least violation of probability in supposing the great and beneficent CREATOR the centre of His works, and from the centre pervading and upholding His wonderful and stupendous creation? And again, may not minor centres typify those beings on whom HE has been pleased to bestow a marked superiority over those around them? Such an one is man, of whom it is said, "In His own image created he him."†

I will suppose them a system composed of an immense multitude of material beings, organic and inorganic, animate and inanimate, revolving in circles around the central, everlasting abode of that Providence who created, pervades, and upholds them, and can, by the act of His will, either annihilate or create anew,—a supposition much more readily admitted than rejected; and, although not positively proved, yet incapable of disproof from man's researches. I will further suppose the minor circles occasionally clustering round major ones; yet I am still in want of some number by which to allot to these circles their respective

* A systematic catalogue.

† Genesis i. 27.

stations, and give something like a primary arrangement to a multitude that would be, without such an assistance to man's capacity, an utter wilderness of beings; and here it will be perfectly useless to devise or invent: the only right plan is carefully to examine all authority within our reach, and steadfastly endeavour to discover truth.

No authority on this subject can be equal to the Scriptures; and there we find the number seven always used as a number of greater importance than any other;—the six days of creation, and the seventh day of rest, from that time more or less observed as a holy or superior day, by divine command,* is the first and one of the most remarkable instances: I need merely mention the seven clean animals which Noah was commanded to take into the ark, the seven plagues, seven years of famine and of plenty, and that more than two hundred other instances occur in the Old Testament. In the New the number seven occurs still more remarkably: as seven golden candlesticks, seven churches, seven angels, and seven spirits of God. I need scarcely go further; but being able to adduce the opinions which have been avowed by the greatest naturalists that have ever lived, I rejoice to strengthen my own opinion by such high authorities. M. le Baron Cuvier, in a paper published in 1795, divided all invertebrate animals into six groups, the vertebrates forming the seventh.† Our eminent countryman, Mr. Kirby, observes: “The number five, which Mr. MacLeay assumes for one basis of his system, as consecrated in nature, seems to me to yield to the number seven, which is consecrated both in nature and in Scripture. Metaphysicians reckon seven principal operations of the mind; musicians seven primary musical notes; and opticians seven primary colours. In Scripture the abstract idea of this number is fulness, completeness, perfection. I have a notion, though not yet sufficiently matured, that Mr. MacLeay's quinaries are resolvable into septenaries.”‡ Our own observation will speedily convince us, that most groups of animals with which

* Genesis ii. 3.

† Translation of Cuvier by Griffith, Vol. I. p. 64, note. Cuvier has since adopted the number four.

‡ Introduction to Entomology, Vol. III. p. 15, note.

we are tolerably well acquainted are divisible into seven; we shall never find the number greater, and when less, we shall invariably perceive that the deficiency exists in groups of which our knowledge is particularly limited, for the perfection of a septenary distribution of any particular group will depend entirely on our acquaintance with that group: thus the groups at present known by the names Mammalia, Aves, and Insecta, resolve themselves instantly into sevens. No ingenuity can frame eight good groups of either, and no scheme, however plausible, can reduce the number to sixes or fives. An attempt to reduce birds into five groups has been made in this country; I cannot do better than refer the reader to it as a triumphant confirmation of the predominance of the number seven.* The great Linnæus assigned to Mammalia seven orders, to Aves six, and to Insecta seven, in a system which, though capable of improvement in many of the orders, evidently points to the truth, and considering his limited means of reference, compared with what the naturalist now possesses, was a remarkable and magnificent monument of human talent.†

To go back two thousand years before the birth of Linnæus, may be thought rather an unlikely mode of obtaining proof of the value of a modern theory in natural history; yet at that time we find a system of insects‡ divided so accurately into seven groups, that every attempt to improve it has, as far as regards these great groups, proved an utter fallacy. Now this array of names, Aristotle, Linnæus, Cuvier and Kirby, thus corroborating Holy Writ, even in direct opposition to our own observations, is entitled to a good degree of confidence; but how much more cheerfully is that confidence given when our own unbiassed judgment must thoroughly coincide!

Presuming, therefore, that a septenary and circular arrange-

* By Mr. Vigers. Linnæan Transactions.

† It will be observed that in the Mollusca, Radiata, and Acrita of Mac-Leay, all attempts to employ a particular number in grouping will be found futile, a circumstance obviously attributable to our ignorance; and the only conclusion to be drawn from it is this: that, as these tribes can never be rendered available for any numerical distribution, so they can never be fairly and satisfactorily adduced in refutation of such a distribution.

‡ That of Aristotle.

ment, with one seventh superior to the others, does exist in nature, its first application must necessarily be made to the result of the six days' creation, which I consider as typifying six grand groups of matter, and the seventh—the day of rest, emphatically commanded to be kept holy—that Omnipotence who created and presides over the stupendous work.*

To trace nature from the trivial differences which may distinguish between two kindred mosses—differences scarcely to be detected by the practised eye of the botanist—upwards to the grand grouping of organized matter, into kingdoms containing myriads of such species,—to define accurately major and minor divisions, and assign to each division, and each individual, its appropriate place in an enduring system, is a task, in all probability, far beyond the mental powers of any single individual, especially when we consider the interesting facts and fresh objects which are daily added to our store in such number as must convince the student that as yet he scarcely possesses a knowledge of one hundredth part of nature's works; † but, to pencil a dim and dubious outline,—to suggest whether nature has not aimed at such and such conclusions,—whether she has not chosen such

* I am fully aware that this part of the subject is far above the comprehension of man, and felt exceedingly reluctant to carry system farther than the two great groups—animals and vegetables; but alluding, as I am compelled to do so frequently, to the works of Mr. MacLeay, I was fearful lest my silence on this particular subject should be construed into consent. See *Horæ Entomologicæ*, p. 179.

† In Britain we labour under another difficulty in this respect, a difficulty which has proved beyond measure mortifying during the progress of the present essay,—the want of a national museum.—A private individual cannot be expected to sacrifice all his time and money in procuring, preparing, and arranging, a tolerably perfect collection; a writer on natural history is, therefore, compelled to travel round to two or three hundred private collections, and solicit leave to make his memoranda. Few men of taste can regret the purchase of the ancient works of art now open to the public at the British Museum; but the immense sums of public money granted to that institution should insure the naturalist a similar treat with the artist. A collection of vertebrate and annulose animals should be immediately formed, arranged, and named after Cuvier, Latreille, or the most approved authority of the day. Among the insecta, I have no doubt a tolerably perfect—certainly, a very useful—collection might with little trouble be made from the specimens already in the Museum.

and such paths, without making the slightest attempt to bend or turn her aside from her course where it does not precisely coincide with his own artificial schemes, may be fairly claimed as the privilege of any of her students, and ought to be freely granted to him by his fellow-labourers.

In looking for a centre around which to arrange the almost infinite hosts of the animal kingdom, the vanity of man naturally enough suggests himself; but to gratify this vanity, he must submit to the somewhat mortifying necessity of admitting six families of apes and monkies to his immediate company, and the tribe thus constituted may be termed *Primates*,—a name originally conferred on it by Linnæus. Anatomy, as well as external appearances, prove the propriety of this arrangement, however repulsive the idea may be to our false feelings of exclusiveness. *Primates* thus constituted, will be found to be the central seventh of a larger group, termed *Mammalia* by Linnæus; a group, which includes all the truly viviparous and mammiferous animals. Amongst the outermost of these, as we retrograde gradually from the type, man, we shall find a bird typified in the bat; a shark in the seal; many other fish in the whale; a tortoise, crocodile, and slender lizards, in the armadillos, anteaters, &c., all thus exhibiting a tendency to borrow characters from other approaching groups. *Mammalia*, thus surrounded, must of necessity be the central of seven groups, within the compass of which will be found all animals which possess a frame of connected bones and a spinal marrow; these are termed *Vertebrata*, and, I think, will be found to constitute a central seventh of all animated nature.

From this it will be apparent, that there are in nature forty-nine groups of animals, each of about the same value as *Mammalia*, as far as regards their relation to a whole. Distrustful of my own very limited knowledge of the subject, and fearful of encumbering science with crude theories and ill-defined divisions and characters which future discoveries may hereafter totally subvert, I shall content myself with observing, that I believe in the existence of such groups, and shall not presume to give them, at present, definitions or even names: the charge of ignorance is merited and easy to be borne, but the charge of attempting to

establish divisions, in order to secure the paltry fame of naming them, I hope not to deserve.

In some instances, these tribes or sub-kingdoms seem pointed out by nature's self in so decided a manner, that the lisping infant will at once recognise them. Where this is the case, what can definition avail? Let us refer to birds as one of these clearly marked divisions. I single it out as better understood than either of the others. Let us ask, To what does all the arrangement tend which has here been so lavishly bestowed? To utter confusion, volume after volume, essay after essay, open their yawning leaves, and repeat, again and again, one and all, utter hopeless, unintelligible confusion. But if, neglecting the high authorities on the subject *in toto*, we condescend to consult nature, we shall soon perceive that birds readily range themselves in seven good and clearly defined groups; one of which is preeminently distinguished from the rest, and yet partakes in some one or other of its component genera of the characters of all the other groups; such a sub-class must, therefore, be central; and, by a little care in availing himself of the most obvious approaches, the naturalist will find every other sub-class, and order, and genus, beautifully filling up their appropriate situations, without causing any of those distortions which so disfigure every existing arrangement of this interesting tribe. Syrrhaptēs, Serpentarius, and all those hitherto paradoxical creatures which seem to have frightened our ornithologists out of their wits, are now not only admissible, but absolutely necessary to connect tribes which no one had previously supposed in the least degree related;—but I will not here forestall, as an attempt to point out the numerous and unlooked-for relations existing among the genera of birds, which the present plan has served to develop, forms the subject of a separate essay, already in a state of forwardness; and the more immediate object of my present inquiry, although a tenant of the air, is not to be sought for among its feathered tribes. I will, therefore, leave these for the present, fully intending that the ornithologist as well as the entomologist shall have an opportunity of examining whether my theory has truth and reason to support it, or whether he must condemn it as an *ignis fatuus* of the brain.

The law that rules animal rules also vegetable nature: the phænogamous plants present a centre very nearly corresponding, in relative value, to vertebrates among animals; these, again, offer equal scope for subdivision; and the surrounding vegetations must be those at present termed cryptogamous, which vary as greatly among themselves as they collectively do from the more perfect and central ones: the various tribes of Fungi, Algæ, Filices, Musci, &c., possessing wonderfully varied forms and characters, and assuming every size from the gigantic fern of the tropical islands to that almost invisible Mucor, which seems, by its instantaneous appearance, to be for ever floating in the air, prepared to vegetate wherever it may chance to fall, and has often afforded arguments to those who deny the dictum of *omnia ex ovo*, and support that of spontaneous reproduction; thus ennobling these almost nonentities, by assigning to them properties which man might pine for in vain, and which cannot be the attributes of dust.

The centre for each particular group will not always derive that mark of superiority from its size, or intelligence, or beauty, or complicated structure, but from a combination of these qualities, and more particularly from uniting in itself the principal and more decidedly distinguishing characters of the group of which it forms the nucleus, and the gradation will by no means be found to be regular, from the most perfect in the centre to the least perfect on the circumference of minor groups, although I imagine this relative position to obtain in the extremes: on the contrary, the approaches towards perfection or imperfection will be infinitely varied, presenting the most complete labyrinth of intricacies that imagination can conceive, yet all disposed with that beautiful and wonderful regularity which proclaims more loudly than words, that “the natural system is the plan of creation itself, the work of an ALL-WISE ALL-POWERFUL DEITY.”*

* Horæ Entomologicæ, preface, p. xiii.

DIPTERA

monius

HYMENOPTERA

ica

ON THE CLASSES OF INSECTA.

Many theories, which read plausibly enough, we find, on attempting to apply them, totally at variance with facts: I will, therefore, not content myself with making unsupported assertions, but endeavour to summon to my aid fragments of the great whole, and array them before the reader, in what I consider order, asking of him, as an especial favour, that he will examine and compare the genera and species which I shall mention as related to each other in corroboration of my scheme; for much as I could wish by argument to convince him that a system of circles, grouped in sevens, exists universally throughout nature, yet I should much prefer that, by actual experiment, he should convince himself. With this view I will take a rapid survey of the central class* of Insecta, observing in what particulars it is related to those which surround it. I have selected insecta first because I already possessed a slight knowledge of its contents; secondly, because there exists little difference of opinion as to those contents;† and, thirdly, because Mr. MacLeay has given it as his opinion “that it is among insects above all other groups of animals, that owing to their myriads of species, the mode in which nature’s chain is linked—a mode, the knowledge of which comprises all knowledge in natural history, will be most evident, and therefore most easily detected.”‡

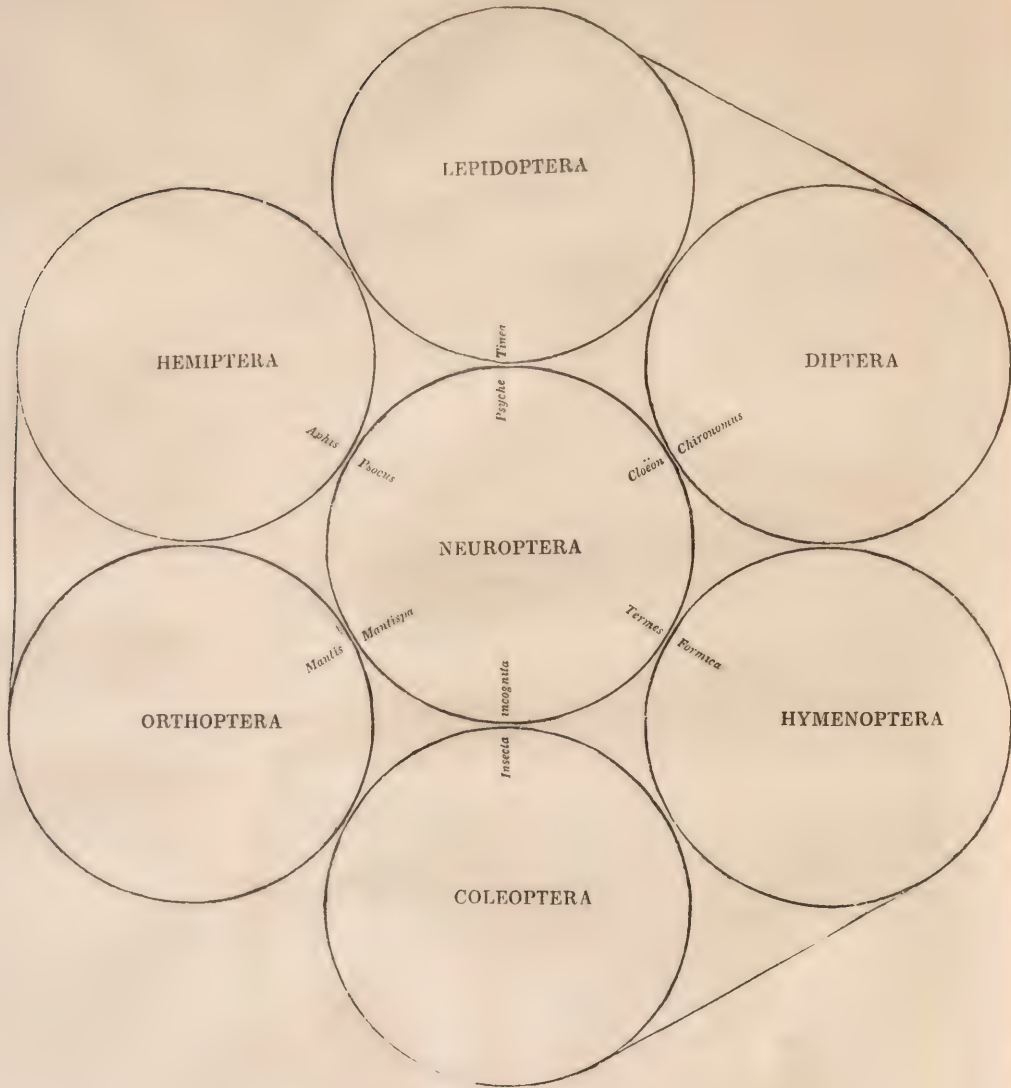
It is somewhat remarkable that, although considerably upwards of two thousand years have elapsed since the first system

* I have invariably used the term class, to designate the orders of Linnaeus, and sub-class, for the next division, of which seven are supposed to exist in every class: these sub-classes may sometimes constitute natural orders, in which case a plural termination is given; thus, *Blatta* constitutes in itself a sub-class *Blatta*, a natural order *Blattæ*, and a genus *Blatta*; but generally a sub-class will contain seven natural orders; as sub-class *Scarabæus* contains natural orders—*Lucani*, *Coprides*, *Scarabæi*, *Histeres*, &c.

† The only question as to the contents of insecta, is, whether the *pediculi* are true insects or not; the class *Hemiptera* is so closely related to them, that I cannot think it a great violation to place them in the outermost circle of that class; the *acari* may be supposed meeting them in an adjoining circle, but I have no desire to provoke controversy on this minor point.

‡ *Annulosa Javanica*, preface, p. xi.

THE CLASSES OF INSECTA.



of insects was promulged, at least the first of which we have any knowledge, yet no attempt has hitherto been successfully made to improve it; from this perfection I think we may fairly conclude, that the philosopher of Stagira was not merely a man of extraordinary talent, but that he had made himself the repository of what had previously been saved of the learning of his forefathers, in a day when it will be recollected the printing press had no existence; and we have nothing to prove that entomology had not degenerated through the two thousand years previous to Aristotle, as it unquestionably did during the two thousand years subsequent to the time of that philosopher, when our own immortal countryman, Ray, revived the science, and laid the foundation of a regenerated lustre, which, perhaps, may eventually rival that diffused by the great Stagirite himself. Be this as it may, the systematist has no choice but to go back two thousand years for the primary outline, or classification of insects; and, I may add, nothing but a desire to make myself clearly understood, prevents my adopting the nomenclature, as well as the division of Aristotle. I shall, however, employ the more modern and less appropriate names for the present, hoping that at a future day an opportunity may occur of doing justice to the merits of that writer, whom we are all compelled to follow, or to forsake the path of truth.*

The reader who does not understand exactly what animals constitute the sub-kingdom Insecta, may refer to the *Introduction to Entomology*, where he will find the subject fully and accurately investigated.† It would be a needless incumbrance of my subject to repeat these definitions here, but as I am unable to meet with any characters for classes, by which relations and differences can readily and conveniently be traced, I have been induced to add a few definitions to those already in use, which I am the more willing to do because they will be useful here without ever perplexing science by forsaking the pages of this essay.

* The learned authors of the *Introduction to Entomology* have inserted a sketch of the Aristotelian system in that work, a reference to which will convince the reader that it is next to impossible for the entomologist to over-rate him. See *Introduction to Entomology*, Vol. IV. p. 433.

† *Introduction to Entomology*, Vol. III. pp. 1—51.

CLASSES.	LARVA.		PUPA.		IMAGO.	
	General character.	Resemblance to Imago.	General character.	Resemblance to Imago.	Wings.	Mouth.
I. LEPIDOPTERA.	Polypod.	None.	Quiescent.	None.	Four, scaly.	Antliate.
II. DIPTERA, <i>Arist.</i>	Apod.	None.	Quiescent.	None.	Two, and two poisers.	Proboscitate.
III. HYMENOPTERA.	Various.	None.	Quiescent.	Slight.	Four, membranaceous.	Mandibulate.
IV. COLEOPTERA, <i>Arist.</i>	Various.	Various.	Quiescent.	Slight.	Two, and two wing cases.	Mandibulate.
V. ORTHOPTERA.	Hexapod.	Perfect, except in wanting wings.	Active.	Perfect, except in wanting wings.	Four, structure various.	Mandibulate.
VI. HEMIPTERA.	Hexapod.	Perfect, except in wanting wings.	Active.	Perfect, except in wanting wings.	Four, structure various.	Promuscidate
VII. NEUROPTERA.	Various.	Various.	Various.	Various.	Various.	Various.

The very imperfection of this table will constitute its principal utility, because, instead of acknowledging variety as a suitable definition of any particular part or state, the differences of which in respective classes, entomologists have been accustomed to consider characteristic, we find authors labouring to confine a group by what they would wish to consider good and solid characters, which characters they often at last leave so comprehensive, as not only to include the class which they had originally intended to define, but also a majority of those other classes which they had supposed previously disposed of. If, in reply, my reader should tell me that my seventh class was somewhat of this too comprehensive kind, I should simply reply that I intended it to be so; and if my reader happen to know a better, he can interline it in his copy. A space would then be occupied, which has hitherto in all such definitions been really, although not verbally, vacant.

It is hard to break through the trammels of habit; it is hard to give up what one has for a long time taken for granted; it is hard to relinquish favourite schemes, however untenable: an innovator, however, is bound to deliberate well and coolly,—is bound to try all the various schemes before him with the test of reason. If the entomologist do this he will find his positive knowledge much less than he expected,—he will perceive that he is book-wise and fact-foolish; if, therefore, he would wish to arrive at truth, he must strip himself of his borrowed garments and all the theoretical dogmas he may have, however incautiously, imbibed, and trust entirely to what he has discovered himself, or what has been discovered by those who had no theory to support but truth,—no end to answer but amusement; for your theoretical writers, if they meet with a fact which militates against a favourite theory, will too often suppress it entirely, and on the same principle are ever anxious to magnify to an unnatural size, any slight, and often imaginary, circumstance, which they consider may tell in their favour. Among theories that have been thus established on very weak and insufficient foundations are all dichotomous divisions, especially those in which one group is defined as possessing and the other as wanting any fixed and peculiar character; a definition, by the by, applicable to nearly all

dichotomies : the dichotomy to which I have here to allude is the division of insects into Mandibulata and Haustellata. Now every division founded on the presence or absence of a particular character should be received with the greatest caution, because the second group in which the character is absent* is sure to be too comprehensive. Mr. MacLeay,† himself no great friend to dichotomies in general, is completely led away by this particular one. He considers the classes I. II. and VI. of the foregoing table to constitute one grand order, and the classes III. IV. V. and VII. to constitute another ; and, after Clairville, he calls the former order, Haustellata, and the latter, Mandibulata. Mr. Mac Leay's name is a tower of strength to any theory ; and his authority, added to the plausibility of the idea, has really given such a truth-like appearance to this division, that we see it now universally adopted. Let us examine its worth. First, I would ask, Can distinctive characters, thus drawn from part only of the external anatomy of insects, be sound, when to enforce them we are compelled to neglect various other characters which we have been accustomed to consider all important ? Scopoli has said, "*Classes et genera naturalia non sola instrumenta cibaria, non solæ antennæ nec solæ alæ constituunt ;*" but our dichotomizing entomologists tell us, that neither antennæ, nor wings, nor habit, nor metamorphosis, are to be regarded at all, but "*sola instrumenta cibaria ;*" at least, they infer this by separating Orthoptera and Hemiptera, by the intervention of several orders totally unrelated to either of them, a disruption which no nature-loving naturalist could for a moment admit. The truth is, there are seven kinds of mouth in insects, so distinct that good classes could be built on them,‡—classes which would confirm those

* And, be it observed, Haustellata merely means *not mandibulate* ; it does not propose to assert that the contents of the tribe so named need have a particular kind of haustellate mouth, or any mouth at all.

† Mr. MacLeay has written a little pamphlet on the impropriety of the dichotomous system, which I recollect reading, when published, with considerable pleasure. I forget its title.

‡ If the reader happen to be unacquainted with the terms which I have used in characterizing the mouth, he will find them accurately and elaborately described in *Ind. to Ent.* Vol. III. p. 393, *et seq.* The orders of Fabricius depend entirely on the formation of the mouth. See *Systema Entomologiæ*.

which Aristotle appears to have derived chiefly from other characters: of these seven, three are mandibulate, three are haustellate, and one without the rudiments of mandible or haustellum. The three which are mandibulate are somewhat similar, the three which are haustellate bear no more resemblance to each other than that which they all may be said to bear to that haustellated quadruped an elephant; and the tie which holds Haustellata together as a group is about as strong as one formed to bend in a genus *Blaps mortisaga*, *Acrida aptera*, *Cimex lectularius*, and the female of *Bombyx antiquus*, with the one sole character of being destitute of wings.

A second fancy which I wish to combat is, that of analogy and affinity; and as Mr. MacLeay is by far the most learned and competent advocate of these distinct descriptions of resemblance, and as I cannot pretend to refer to or cope with the voluminous writings extant on this subject, I am necessitated to allude to his work alone. It will be seen by the *Horæ Entomologicæ*, (a work which I have already spoken of with unfeigned admiration,) that Mr. MacLeay considers that relation observable in the general appearance, habit, food, metamorphosis, &c. of insects, a relation of analogy, while that dependent solely on a fancied resemblance in the mouth he considers a relation of affinity: thus classes V. and VI., which, in five characters out of six, agree as closely as such comprehensive classes can do, he considers related by analogy, and classes I. and VI., which, in five characters out of six, are as unlike as insects can be, he considers related by affinity;* so Dr. Johnson, when he calls affinity "resemblance," must have made a capital blunder, for Mr. MacLeay proves clearly that it means dissimilarity. Classes I. and VI. however, I find will meet as the line becomes bent into a circle, and therefore we must conclude it to be a hidden affinity, for it certainly is not apparent; and moreover it must be remarked, that the relation between classes is but little apparent generally, except they are taken in pairs: thus, between I. and II., between III. and IV., and between V. and VI., the relation is real and readily ascertained, although distant; while between

* *Horæ Entomologicæ*, p. 367.

II. and III., between IV. and V., and between VI. and I., it becomes scarcely traceable. It is also worthy of notice, that the contents of either pair of classes, with the addition of class VII., may be formed into a tolerably perfect chain of genera, indeed with much less appearance of disconnexion than is observable on passing from either pair into the next pair,—a fact which attaches a degree of importance to the number three, on which, perhaps, at a future time, more may be said,—and thus a chain of relation would be established in each instance, leaving four whole classes entirely out of the question;—a chain which would steadily pursue its way, regardless and in open violation of all established laws of analogy, affinity and dichotomy; laws which I hope ere long to see pining away like Echo, until they also are really what I now fully believe them to be, *vox et præterea nihil*.

Mr. MacLeay found that in his quinary groups one of each five contained genera or species related to other genera or species in each of the other four groups. That I may be thoroughly understood, I will quote the author's own words:—"In almost every group which has been set before the reader, he must have perceived that one of the five minor groups into which it is resolvable, bears a resemblance to all the rest; or, more strictly speaking, contains types which represent each of the four other groups, together with a type peculiar to itself."* As far as my observation has extended, this is universally the case; and whether the total number of groups be five or seven, I think I am safe in asserting that the only possible way of making these types, thus representing groups, approach such groups, is to place the heterogeneous group in the centre, and the homogeneous groups around it; taking care that the type peculiar to itself be its very centre, its "heart's core." Such a heterogeneous group, then, is Neuroptera: its characters as given,† I believe, perfectly correct; and can any one say they are sufficient? Certainly not; but had I described it thus—Class VII. Neuroptera, central, partaking of the characters of all the others, I think a better character could not have been given. This class contains a type peculiar to itself—the genus *Libellula* of Linnæus: a genus so

* *Horæ Entomologiæ*, p. 518.

† See the Table.

distinct, that several authors have supposed it to constitute one of the primary divisions of Insecta. It is, however, merely the Neuropterous type, the very essence of the class; and many of its species, *Anax Imperator* for instance, proclaim themselves by their imperial flight, their enormous size, their richly variegated colours, their despotic and cruel habits, emperors of the insect world. In this group we find the organs of sight, manducation, and locomotion, carried to a greater degree of perfection than we ever meet with, except in similar centres: like the king of birds, the dragonfly is unrivalled among his kind. From *Libellula*, the centre, we descend at once to *Tinodes*, or *Psyche*, on the circumference of the circle. Supposing *Psyche* to be the approaching genus to *Lepidoptera*, I think I need not enter very diffusely on the similarities. Passing to the right, we find that *Diptera* will next touch the central class; in which, after leaving the *Phryganeæ*, we have now arrived among the next group, or sub-class, *Ephemera*: and here, as we might expect, the inferior wings become much diminished—at the point of contact obsolete.* The flight, instead of being solitary, is in company, gracefully and gently rising and falling. The parts of manducation are become obsolete; while, in habit and appearance, the insect imitates the *Tipulæ* and *Chironomi*, so exactly that the naturalist is foiled in his endeavours to distinguish between them, as they joyously dance together by myriads in the rays of the setting sun.

We now approach mandibulated orders, and we shall see the loss of mandibles in *Phryganea* and *Ephemera*, although apparently resulting naturally enough from their distance from the type *Libellula*, has yet another cause—the proximity of classes that have no mandibles: in the city-building *Ants*, the mandibles are very perfect, and, therefore, we may expect them, and we find them in the city-building *Termites*. The opinion of philosophers, such as the authors of the *Introduction to Entomology*, is always worth having, although I am doubtful of assertions about insects, when unconfirmed by thorough entomologists; and I believe as yet no entomologist is sufficiently acquainted with the real history of white ants, to decide positively as to their different

* In *Cloëon*.

stages of existence. The following quotation contains also a corroboration of the propriety of this approach:—"The white ants, though they belong to the Neuroptera order, borrow their instinct from the hymenopterous social tribes, and, in conjunction with the ants, (*Formica*,) connect the two orders. Their societies consist of five descriptions of individuals:—workers, or larvæ; nymphs, or pupæ; neuters, or soldiers; males and females."* The class Coleoptera now approaches the Neuroptera, and on each side the boundary we find larvæ digging pitfalls in the sand to catch their prey, and having tubular mandibles to extract its juices when caught. We find them spinning silken cocoons, in which they change into quiescent pupæ, incapable of taking nutriment; which may fairly be supposed a symptom of approach; but there is no insect whose imago I would venture to place on the circumference of the neuropterous circle at the point.

When we find an insect so doubtfully situated between two classes, that Linnæus placed it in Neuroptera, Fabricius in Orthoptera, Latreille, in two of his works, in Orthoptera, and in two others in Neuroptera, MacLeay in Neuroptera, and Kirby and Spence in Orthoptera, I think it but fair to conclude, that the orders must approach very nearly to admit of this difference of opinion: such is *Mantispa*; and Mantis-like as it really is, it only borrows that appearance from being on the extreme circumference of the Neuropterous circle, and touching the Orthopterous one where Mantis must evidently be situated. Lastly, we see in *Psocus* the form, wings, and whole appearance of *Aphis*, so exquisitely imitated, that practised entomologists often, nay mostly, fail in separating them correctly: thus we find that class VII. contains five natural orders, the contents of which have been—and may be again, should the linear and dichotomous system continue in vogue—placed either in the class to which they truly belong, or respectively in classes I. II. III. V. and VI. at the mere option and caprice of the systematist. I have already admitted that I find no neuropterous insect sufficiently related, in its final state to class IV. to warrant my placing it in contact with that class; and that I may not be accused of assuming

* Introduction to Entomology, Vol. II. p. 32.

facts which exist only in my imagination, I am perfectly willing to conclude that no such insect is to be found; a conclusion that time and discovery, by falsifying, can only add yet one more buttress to a tower, which nature seems to point out as built by herself.

There are a few little insects which, like the spiders which crept across Richard's brain, are somewhat perplexing to the naturalist, yet he cannot dispose of them as the monarch did of his spiders; I mean *Pulex*, *Stylops*, *Thrips*, *Forficula*. But, in truth, the first attempt of the systematist should be to place classes properly, and these disconnected species will, after a time, find appropriate places: they were no more created without a design than man; and their Creator, doubtless, has appointed them a station, although man, whose wisdom is utter ignorance, has not yet been able to discover it. It is impossible for the entomologist not to observe the general similarity, the family likeness if I may so express it, which exists between these genera; they appear a little way removed from *Coleoptera*, yet will not harmoniously join that class. *Thrips* is evidently mandibulated, although the dichotomists call it haustellated, and comes nearer to *Stylops** than any other known genus: its larva is, I believe, unknown; but in March you may observe an active hexapod, lizard-like animal, running about the flowers of *Ranunculus ficaria* on sunny banks, and two or three months later you will find *Thrips* abundant on the same flowers in the same spots: this is no proof of their identity; but as the larva of *Thrips* and the imago of the said hexapod are equally unknown, there may be a surmise expressed on the subject. Mr. Kirby calls this hexapod *Pediculus Melittæ*, and has given a description and plate of it in his *Monographia Apum*.† He there asserts that De Geer considered it the larva of the *Melœ proscarabæus*, and some observations of my esteemed friend, Mr. Doubleday, who

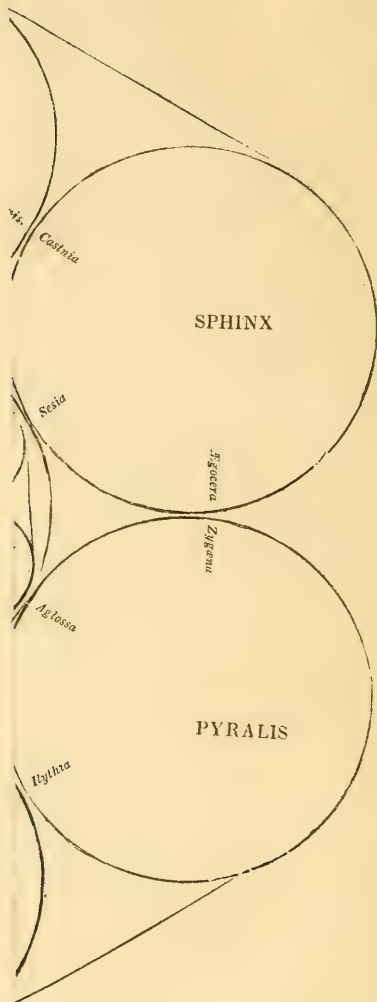
* For a beautiful and accurate figure and dissections of this rare insect, see Curtis's *Entomology*, pl. 226: for a popular figure, *Professor-edly* of the same insect, see *Insect Transformations*, p. 67.

A little knowledge is a dangerous thing.

Drink deep, or taste not the Pierian spring.

† *Monographia Apum*, Vol. II. p. 168.

OPTERA.



succeeded in obtaining the larva of *Melœ* from the egg, certainly tended to corroborate De Geer. But I am rather wandering from my subject, and, therefore, will consider these little creatures also, wandering like comets in eccentric courses over the whole system, now approaching *Staphylinus*, and anon *Ichneumon*, and, as they draw near, borrowing a character from each: they may, on the other hand, constitute disconnected links of some other mighty chain, the intervening parts of which are for a time hidden from the sight of man, and perhaps hereafter may be revealed; perhaps, again, they may occupy some of the chasms I have been compelled to leave vacant: but I deprecate, I detest the idea, of forcing any creature into a situation which nature has not evidently pointed out as its appropriate one, for the ignoble purpose of giving plausibility and imperfect perfection to a scheme.

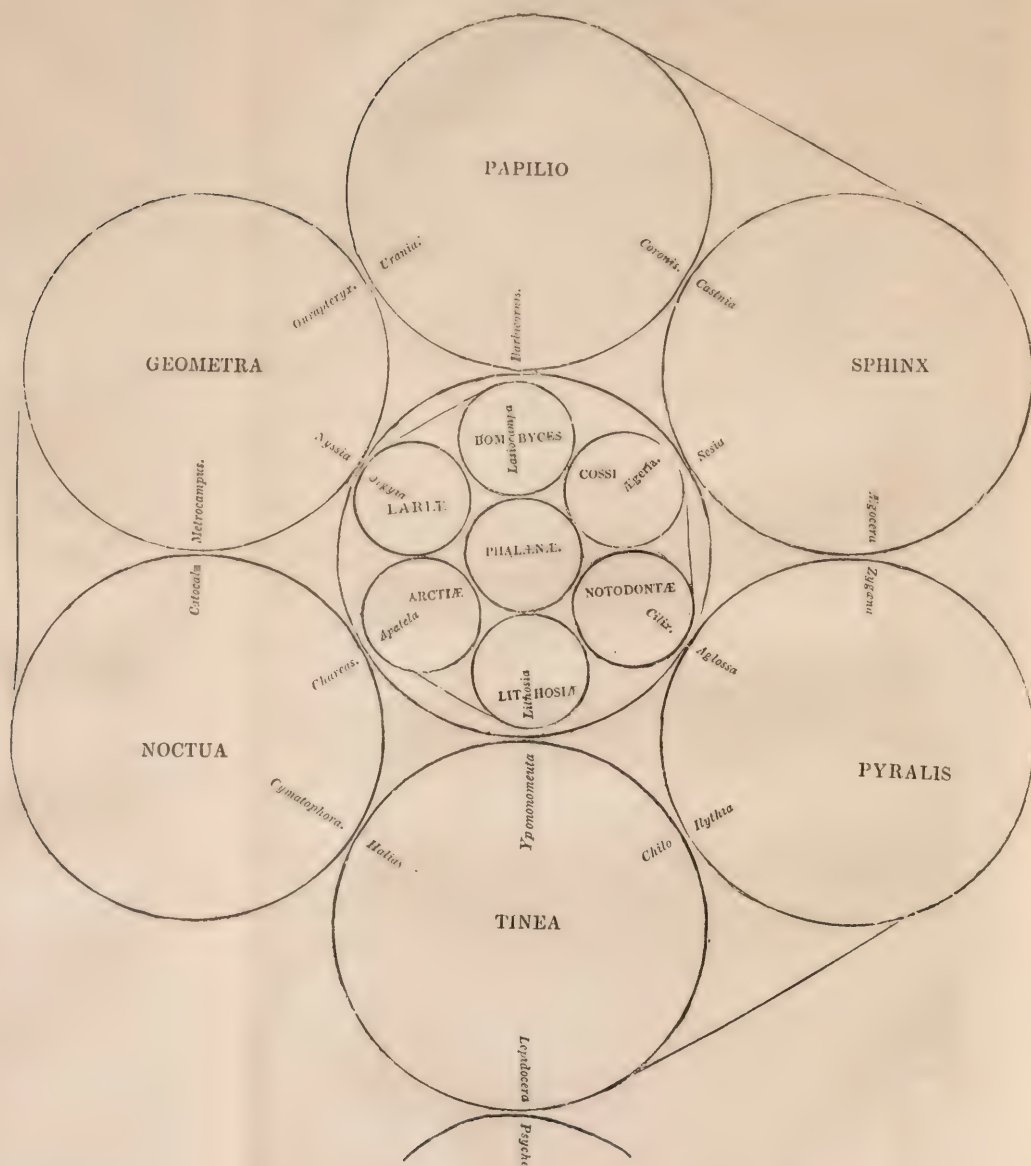
ON THE SUB-CLASSES, &c. OF LEPIDOPTERA.

It may be thought a strange propensity to grapple with difficulties, that leads me to select *Lepidoptera* as a class, by which to exemplify, in detail, the septenary and circular arrangement. There is no class so puzzling to systematists, or for which science has done so little—no class is at present so badly arranged, and in none are barbarous combinations so much in vogue. *Linnæus* founded divisions at the outset, on characters, “loose, vague, and insufficient:” * modern genera have a little improved minor details, and but little, for their places appear to have been assigned them by lot, and without the slightest regard to similarity or approach: in a word, the arrangement of *Lepidoptera* appears to have been conducted by collectors, who aimed rather at a pretty picture than a related series; and all our writers have rushed headlong by the same path, without staying an instant to consider whether they were right or wrong, like boys playing at follow-the-leader,† each occasionally leaping some wider gap, or descending some more dangerous precipice than his predecessor, as though for the very love of frolic and bravado. *One*, a talented writer, an assiduous collector, a most accurate observer,

* Particularly in the sections of *Papilio*.

† *Linnæus*.

SUB-CLASSES OF LEPIDOPTERA.



hesitated awhile, it is true, and it was thought he would have broken the line, but no,—he kept precisely to the track of Linnæus and the rest of them, through Papilio, Sphinx, Bombyx, Noctua, Geometra, Pyralis, Tortrix, and Tinea; but, as he stood pledged to traverse no more than five fields, he hit on the ingenious expedient of asserting roundly, that the four last named were but one. In fact, the whole of this immense class presents, at this hour, nothing but a vast chaos, which seems to await the operation of some predicted spell to call it into order.

These were apparent difficulties only; for, as no system existed to direct, so none existed to encumber or perplex. Too much is known now of Linnæan combinations, to assert, that he always thought correctly; and since his day no one has thought at all. Now, if you cannot obtain a nicely drawn plan, you prefer having a blank sheet of paper to one covered all over with scorings and markings, and then you may set to work and make your plan yourself. So, in natural history, contrariety of opinion perplexes, while the absence of opinion leaves the systematist perfectly unbiassed in the formation of his own. Again, copious and well-named* collections of this favourite class are by no means uncommon;† and through, the liberality of my friends, I had often been permitted to inspect them, and had gained a sufficient superficial knowledge of their contents, to be enabled, with the assistance of my own specimens, to cluster them pretty well into seven great families or sub-classes; and although, as I have noticed, nothing available existed on the subject of arrangement of Lepidoptera, either in essay, or treatise, or catalogue, or cabinet, yet there was to be found, up and down, much valuable matter, in the shape of what might be termed natural history of Lepidoptera. Finally, I knew, that could I master this class, I could stand my ground, because I had previously tried the experiment on the classes Hymenoptera and Coleoptera, and had found that, at the word seven, they fell into instant order, as at the touch of a magician's wand; and, as for the other classes, we are in such innocent and blissful ignorance of their contents, that were a scheme ever so futile, a century at least must elapse before its futility could be proved by Orthoptera, Hemiptera, or Diptera.

* I mean each species labelled with a name.

† British collections.

Whoever will give himself the trouble to examine thoroughly a collection of British Lepidoptera, will find a very great majority of them evincing very evident symptoms of relation to one or other of the following species : — *Papilio Machaon*, *Sphinx Ligustri*, *Pyralis verticalis*, *Tinea pellionella*, *Noctua pronuba*, and *Geometra roboraria*; and should any form widely different from either of these occur, it may, if the larva be known, be placed in the centre of a ring formed by the groups, which we will suppose surrounding their six respective types; or, if its larva be unknown, it must await the discovery of that most unerring stage of its existence. I am persuaded, did entomologists know how much depends on the form, habit, food, and clothing of larvæ, they would not be so neglected as they are at present. I have much to regret my own remissness in this respect, for it has seldom happened that I have found the larva of any insect which had not been previously well known, but it has tended to point out some approaches that had never before been thought of,—approaches, even when thus pointed out, totally irreconcilable with existing ideas of arrangement and combination of groups, but which now open to my view the most beautiful chains of affinities; and wonderfully but indubitably prove, that a single individual may be related to three, four, or even more apparently disconnected groups.

Perhaps no better genus was ever formed than *Papilio* of Linnaeus; its diurnal flight, its erect wings, and its clavated antennæ, at first bid defiance to the systematist who attempts to bring any other group into contact with it; indeed, in Britain we have nothing at all that will avail us in this respect, which compels me to have recourse to exotics, an assistance which I shall only avail myself of when I find it quite impracticable to furnish the approaches from indigenous species, the reference to which is attainable by every entomologist. Among foreign *Papiliones*, especially among those groups which approach our genera, *Hesperia*, *Lycæna*, *Polyommatus*, and *Thecla*, there appears to be an almost infinite variety of form. Now it is but reasonable to seize on any variations observable in genera or species from the prominent or typical genus or order from which they may be supposed to derive their more conspicuous character, and to employ such variations in

arrangement as connecting links between the group to which they more decidedly belong, and the group to which, by such variation, they evince an approach: a precisely intermediate species or genus between two classes or sub-classes, or even orders, I have never met with, notwithstanding the renowned Linnæan maxim, that *Natura saltus non facit*; for did nature make no leaps, surely the question were immediately at rest as to the existence of any other division than species among created beings, a conclusion which even the most strenuous supporters of the Linnæan dogma decidedly resist. Among the Papiliones, this departure from the type may be looked for either in the form of the antennæ, the position of the wings, or the time of flight. The first is obviously the most tangible should it occur, and it does occur. In *Urania*, the antennæ have become setaceous; the club has entirely disappeared, yet the other peculiarities remain much as in *Papilio*. This single deviation may be assumed as pointing out a relation to *Geometra*, which the reader will perceive is supposed to meet the sub-class *Papilio* at this point. A second peculiarity is to be found in an insect figured by Godart, a *Polyommatus* in shape, but with pertinated antennæ;* the genus he has very suitably named *Barbicornis*. This deviation, it must be observed, is in favour of the *Bombyces*, which we therefore suppose touching the sub-class at this point. A third deviation, of a very different kind, is observable in an insect which Latreille has figured in the *Règne Animal*, and placed among the *Sphinges*: he calls it *Coronis D'Urvillii*. The antennæ in this genus, as in *Castnia*, are gradually incrassated, and they may probably be eventually both considered as *Papiliones*: of *Coronis D'Urvillii*, I cannot entertain a doubt, as the wings are too expansive, the antennæ too long, the abdomen too short for it ever to retain its station among the *Sphinges*; the inferior wings are also very decidedly caudate, a common formation among *Papiliones*, but unknown among *Sphinges*; but, let this question be eventually decided *pro* or *con*, the approach between *Hesperia* and *Sphinges* is not

* Latreille seems to think this to have been a deception, and that the antennæ which Godart found on the insect did not belong to it. I cannot suppose that the latter author could have been so grossly deceived.

likely to be disputed, nor the fact that it takes place somewhere in the neighbourhood of the genus *Castnia*.

The next type is *Sphinx Ligustri*; and here again our British collections are obliged to plead poverty; few, however, as they are at present, I am compelled, if I purpose consulting nature, to reduce them about half: the *Ægeriæ* and *Zygænæ* must be moved elsewhere; they look like *Sphinges*, but are none. I will begin then with *Castnia*, of which no more need be said. The next striking departure from the type occurs in having the abdomen furnished with tufts or brushes, which the insect spreads as it hovers over flowers, somewhat in the manner of a bird's tail. The long porrected antlia also has a resemblance, perhaps rather fancied than real, to the slender bill of a humming-bird, whence the tribe has received with us the name of English humming-birds. The genus *Sesia* I will place on the circumference of the circle, not doubting but nearer approaches to the *Cossi* may be discovered, or are even now known, but no better exists among our own *Sphinges*. The next point of contact will be with *Pyralis*; and here the genus *Ægocera*, figured in the *Regne Animal*, seems to claim its station: it is a decided *Sphinx*, with the palpi of *Hypena proboscidalis*, and Latreille has placed it between *Sesia* and *Zygæna*, from which it will be seen that I differ only in making *Zygæna* pass over the boundary line and into the next section.

We enter the third sub-class then at *Pyralis*, and find ourselves among some of the most beautiful little creatures in existence—sylph-like beings, which spend their lives in the brightest sunshine and among the sweetest flowers. Linnæus considered them *Sphinges*, from what character is not very apparent: the sub-character, applicable only to this section, is certainly correct; they are truly “*larva diversæ*.” As for the antennæ being “*medio crassiores*,” it is not the case, unless the increase and decrease of pectination can be considered as making them so. Of this particular tribe Latreille observes, “*Les autres lepidoptères de cette division ont dans les deux sexes, des antennes garnies d'un double rang de dents alongées ou bipectinées. Ceux qui ont une trompe distincte forment le genre Glaucopis; ceux où cette organe manque ou n'est pas distinct celui d'Aglaope—ces crépusculaires semblent*

se lier avec les Callimorphes." The approach of the genus *Aglaope* to *Aglossa*, rather than to *Callimorpha*, seems to be presumable from the circumstance of its not possessing a tongue, the genus *Glaucopis* having more similarity to our genus *Pyrausta*, while some of its species, which appear to call for further generic division of the order, are closely allied to our *Botys literalis*, &c. The only British genera of this order are *Zygæna* and *Ino*; the latter, however, appears to be merely a species of some extra-European genus, as I have remarked several exotics of precisely similar form. The insects of this order have a stout and rather hairy larva, much like those of the generality of the sub-class, and in no respect allied to that of the *Sphinges*. Early in the summer they spin a glossy silken cocoon, generally attached to blades of grass, and remain but a few days in the pupa state. A great proportion of the perfect insects have hyaline spots and patches in their wings, and nearly all of them are brilliantly coloured. It is known that Linnæus occasionally, as in *Tenebrio* and the present instance, made his genera recipients of species, which he found a difficulty in locating properly; but it is really astonishing to find a naturalist like Latreille abiding by so absurd a combination as the contents of the Linnæan genus *Sphinx*, and, in servile imitation, calling creatures which nothing but an unclouded sun ever tempts abroad—*Crepuscularia*.* It is no part of my present plan to assign names to orders, or to describe their contents, except in those particular instances in which the more immediate object of this Essay may render it imperative. I will, however, just observe, that I by no means consider *Zygæna* the type of the order, but merely the nearest point of contact with *Sphinx*, and an evident departure from its true type, which perhaps may be found in that ill-divided genus *Glaucopis*, the form and appearance of which is altogether more *Pyralis*-like than *Zygæna*. I am well aware that *Ægocera* and *Zygæna* do not harmonize so beautifully as many other approaches, and fully expect to see the connexion between these sub-classes much improved; but I have seized on these genera as demonstrating a tendency in each individual towards the sub-class to which it does

* *Volatu vespertino*, *Lin.*

not belong. The circumstance of *Zygæna* having been so long considered a *Sphinx* will warrant its situation on the very circumference of the circle which contains its order, until a more appropriate occupant of that situation can be found. At the central point of contact, the genus *Aglossa* presents a very *Bombyx*-like appearance; its shape, its want of the antlia, &c. indicate approach; and from the sub-class *Tinea*, the division of *Pyralis* is at present an imaginary one: at this point, after making what little comparison I am able, I am induced to place *Galleria*, *Melia*, and *Ilithya*, in *Pyralis*; and *Chilo*, and *Crambus* in *Tinea*.

The fourth sub-class, *Tinea*, far exceeds in numbers either of the others, and probably all of them together; and where such a multitude of species exists, great diversity in form and habit may be expected: the *Pterophori* are a most singular tribe, and greatly resemble the *Tipulæ* in many respects. I feel by no means certain that their situation would not be better between the lepidopterous sub-class, *Tinea*, and the dipterous sub-class, *Tipulæ*, thus throwing them completely out of the lepidopterous circle; but this I leave. I am now only sketching a rough and hasty outline from nature. If I attempt to finish my drawing as I proceed, I shall find occupation sufficient for a lifetime. I have observed that I considered the chain of relation entering from the last sub-class at *Chilo*, or about that genus; the same order must of course include *Crambus*, and its congeners; the next order will contain *Yponomeuta*, which I will place at the point of contact; and the next point being among the true *Tortrices* will drive *Halias fagana* as a decided departure from their typical form to the very circumference of the circle where it touches *Noctua*.

The fifth sub-class, *Noctua*, seems to be but one mighty genus: we will enter it from *Halias fagana*, an insect so nearly allied to *Noctua* in its larva, its pupa, and its imago, that for a long time I hesitated to which sub-class it belonged; again, in *Cymatophora*,* *subtusa* and *retusa*, I was fearful that by

* Ochsenheimer places *Oo* in this genus, and I observe Mr. Stephens confines the genus to that one species. Mr. Curtis places *Oo* in the genus *Bombycia*: this confusion of genera is very puzzling, but I hope, by mentioning species, to make myself understood. *Oo* is not at all applicable to my purpose.

considering them Noctuæ, I might deprive the order Tortrices of a genus on which perhaps many curious combinations might depend, and I now only place them in Noctuæ until I may have an opportunity of examining their larvæ, which I have not yet been fortunate enough to meet with. Towards the central sub-class there appear to be many genera which approach the line of contact; *Agrotis* and *Chareas* for instance.* I prefer taking the latter, and must mention the species *Graminis*, as I am fearful of encumbering my system with species to which I not only never intended to refer, but should probably place in some distant order, or perhaps sub-class. At the approach to *Geometra*, the genus *Catocala*, from its looping larva, seems to have a right to be placed: this I, however, look on with suspicion, as the larva appears to me any thing but a guide in the connexion of sub-classes; but I here succumb to customary usage in making this genus the approach to the real loopers, objecting, however, to the intervention of *Phytometra*, *Euclidia*, and *Brepha*.

The sixth and last of the exterior sub-classes is *Geometra*, and we shall find one insect which is completely a *Geometra*, and yet in the larva has two additional feet, and the abdominal fringe of *Catocala*: this is *Metrocampus margaritaria*,† an insect, without which the connexion of these sub-classes would have been difficult to establish. The next species I am acquainted with seems to be *Rumia cratægaria*, and after it the Thorn moths, as they are termed (*Crocallis*?): these lead to *Geometra*‡ in the centre, which may be considered the farthest removed from any of the surrounding sub-classes; from the genus *Geometra* a line may be drawn through *Biston*, *Nyssia*, and *Hybernia*, to the point of contact with *Phalæna* in the centre, and another through *Boarmia*, *Abraxas*, and *Ourapteryx* to *Urania*, from which genus of *Papiliones* perhaps the reader will recollect we set out.

The seventh and central sub-class, *Phalæna*, now claims our attention. The mere circumstance of having taken a little

* Perhaps *Noctua Lambda*.

† Of Mr. Curtis's *Guide*. I cannot consider *fasciaria*, Mr. Curtis's next species, at all allied.

‡ *Alcis*. Curtis.

tour round it gives but a very poor idea of its contents, and although my reader may assure me he knows them sufficiently well already, that assurance will by no means satisfy me that he and I are at all agreed either as to what those contents may be, or as to their relative situations. Before, however, I again set in earnest to the task of pointing out relations and approaches, I feel that some apology is due for attempting the restoration of a beautiful and euphonious name to that grand group of Lepidoptera, to which it was originally assigned by the eminent naturalist who was the first to define and name such groups.* I am fully aware this is an attempt at innovation for which I can never be forgiven by the scientific; for the merit of the present day seems to consist in the total neglect of grouping and classifying, and in making a host of imaginary genera and species, for the mere pleasure of overwhelming us with a “far-rago” of barbarous and unutterable names,—a practice which my unsophisticated and old-fashioned notions will never dwell on with that deferential awe which such profound science has an undoubted right to expect.

Again, on the subjects of *orders*, a term I have already been induced to use now and then, I am quite aware that I here am guilty of another misdemeanour, and more especially as I call them natural orders, meaning thereby orders among the contents of which nature has established the similarity; and to the formation of which “the cunningly devised fables” of man have contributed but very little; and meaning also that nature has implanted in us all, more or less, the power of distinguishing such orders by a mere glance, and without any reference to our books.

Furthermore, the naming of orders which I have been obliged to mention by name, in the unscientific way which I have adopted, merely making them plurals of established names, of large and overgrown genera, I acknowledge to be a confession of ignorance not usual in this our day, especially as these old genera have almost in every instance the disadvantage of being euphonious, easily pronounced, expressive, and universally understood; and

* Linnaeus.

an opportunity once missed of coining names for three hundred new orders, (and each might have been a combination of consonants which no one could spell, or speak, or read, or understand,) alas! alas! may never occur again.

To return; I suppose the sub-class *Phalæna* to contain seven natural orders, a number precisely similar to that discovered from observations made on the larva by that most accurate and indefatigable naturalist, Dr. Horsfield;* and I may add, my own divisions are derived from the same source, together with the pupa and whole habit: the perfect insect has no characters, hitherto discovered, by which we can ascertain either sub-class or order, and from this circumstance I am compelled to omit those genera of whose larvæ I am ignorant,† and even to leave

* I regret not having Dr. Horsfield's work to refer to; but I believe I am perfectly safe in stating from memory that these seven he considered typed in the genera, *Saturnia*, *Lasiocampa*, *Cossus*, *Cerura*, *Arctia*, *Laria*, and *Lima-codes*: two of these he manages to unite to other two, in order to reduce the number to five, but I forget which.

† As the genera which I must mention ought necessarily to be drawn entirely from one work, in consequence of authors differing as to their contents, I have adopted those in Mr. Curtis's *Guide*, invariably: below is a list of the genera he has given in this section, with my own idea of their situation attached to each, and the addition of six genera, which Mr. Curtis does not consider as belonging to the sub-class *Phalænæ*:

789 <i>Trochilium</i> . . . 2 Cossi.	806 <i>Saturnia</i> . . . 7 <i>Phalænæ</i> .
790 <i>Ægeria</i> . . . 2 Cossi.	807 <i>Eriogaster</i> . . 1 <i>Bombyces</i> .
791 <i>Hepialus</i> . . . 2 Cossi.	808 <i>Clisiocampa</i> . 1 <i>Bombyces</i> .
792 <i>Cossus</i> 2 Cossi.	809 <i>Lasiocampa</i> . 1 <i>Bombyces</i> .
793 <i>Zeuzera</i> . . . 2 Cossi.	810 <i>Odenestis</i> . . 1 <i>Bombyces</i> .
794 <i>Stauropus</i> . . 3 <i>Notodontæ</i> .	811 <i>Gastropacha</i> 1 <i>Bombyces</i> .
795 <i>Pygæra</i> . . . 3 <i>Notodontæ</i> .	812 <i>Hypogymna</i> . 6 <i>Lariæ</i> .
796 <i>Clostera</i> . . . 3 <i>Notodontæ</i> .	813 <i>Orgyia</i> . . . 6 <i>Lariæ</i> .
797 <i>Notodonta</i> . . 3 <i>Notodontæ</i> ?	814 <i>Laria</i> 6 <i>Lariæ</i> .
798 <i>Pterostoma</i> . 3 <i>Notodontæ</i> .	815 <i>Arctia</i> . . . 6 <i>Lariæ</i> .
799 <i>Petasia</i> . . . Sub-class <i>Noctua</i> .	816 <i>Arcturus</i> . . 6 <i>Lariæ</i> ?
800 <i>Episema</i> . . . Sub-class <i>Noctua</i> .	817 <i>Spilosoma</i> . . . 5 <i>Arctiæ</i> .
801 <i>Colocasia</i> . . 6 <i>Lariæ</i> .	818 <i>Phragmatobia</i> 5 <i>Arctiæ</i> .
802 <i>Dimorpha</i> . . 3 <i>Notodontæ</i> ?	819 <i>Penthophera</i> Order uncertain.
803 <i>Cerura</i> . . . 3 <i>Notodontæ</i> .	820 <i>Eyprepia</i> . . 5 <i>Arctiæ</i> .
804 <i>Ptilophora</i> . 3 <i>Notodontæ</i> ?	821 <i>Eulepia</i> . . . 4 <i>Lithosiæ</i> .
805 <i>Endromis</i> . . Order uncertain.	822 <i>Hypercampa</i> 4 <i>Lithosiæ</i> .

those as doubtful, of which I possess but a partial knowledge of that state.

Natural Order—*Bombyces*. Has an elongate cylindrical downy larva, which rolls itself into a ring when touched; the pupa changes in a close gummy oval cocoon, remarkably small for the size of the imago. Among the exotic species of *Lasciocampa*, we find in the males particularly slender bodies, expansive wings, the inferior grooved to receive the abdomen, and diurnal flight, all of them characters so indicative of an approach to *Papilio*, that we scarcely hesitate a moment in assigning it the approaching station, not but I expect fully that time will eventually furnish us with a connexion on each side yet more conclusive.* The second genus of *Bombyces* is probably *Odenestis*, and the third *Gastropacha*, whose prominent and elongated palpi appear to point out an approach toward a tribe of insects with the same peculiarity, of which there are several to be found in the following order:

Natural Order—*Cossi*. The larva is depressed; naked, except a very few scattered hairs; has sixteen feet; lives through one or more winters; never rolls itself in a ring when touched; feeds on the solid interior woody parts of vegetables. The pupa generally changes in a tough oval cocoon, interwoven with particles of its food. It has a double ring of raised denticulations of each segment of the abdomen, by means of which it is endowed with a considerable power of locomotion. The genus *Zeuzera* is very near the point of contact with the *Bombyces*. In *Zeuzera* there is much resemblance to the antennæ of *Gastropacha*. One genus, or group of genera, I expect will prove to be *Stygia*, a native of New-Holland. A second, at the point of contact with *Sesia* in *Sphinx*, must be *Ægeria*; thus retaining its place among

823 <i>Callimorpha</i> . 4 <i>Lithosiæ</i> .	829 <i>Limacodes</i> . Order uncertain.
824 <i>Deiopeia</i> . . 4 <i>Lithosiæ</i> .	854 <i>Acronycta</i> . 5 <i>Arctiæ</i> .
825 <i>Lithosia</i> . . . 4 <i>Lithosiæ</i> .	942 <i>Platypteryx</i> . 3 <i>Notodontæ</i> .
826 <i>Nudaria</i> . . . Sub-cl. <i>Phryganea</i> .	943 <i>Drepana</i> . . 3 <i>Notodontæ</i> .
827 <i>Psyche</i> . . . Sub-cl. <i>Phryganea</i> .	944 <i>Cilix</i> 3 <i>Notodontæ</i> .
828 <i>Heterogena</i> . Order uncertain.	

* See a *Papilio* with the antennæ of a *Lasciocampa*, Drury, Vol. III. pl. v.

British insects, immediately between *Sesia* and *Cossus*.^{*} This is the first of a series of the most beautiful instances of approach, or rather, of what ought to be termed *relations of analogy*, that any system has ever previously disclosed. As a few words will again be necessary on this subject, I refrain from any further observation here, than merely requesting the reader to examine how minutely the *Sphinx* characters are appropriated by a true lignivorous *Phalæna*, which cannot be said, in any of its prior and principal states, to have the most distant approach to *Sphinx*. A third genus is, probably, the strange and paradoxical exotic *Oiketicos*, which has been minutely described in the *Linnæan Transactions*; and a fourth is *Hepialus*.[†] This genus has some slight points in which it differs from the others of the order already known, the larva being radicivorous only, seldom or never ascending internally the stems of plants: it changes in the earth.

Natural Order—*Notodontæ*. The larva is naked, has sixteen feet, and is, in different genera, furnished with excrescences, and apparent distortions in various parts of the body. The eighth or last pair of feet, and three last segments of the abdomen, are elevated; when the insect is at rest, the head and first segment are raised in a similar manner. In one genus (containing *Camelina*) the head and extremity of the abdomen nearly meet over the back, when raised in this singular manner. The posterior feet are frequently useless in walking; in some genera, entirely obsolete. The pupa is smooth, in a cocoon, mostly among dead leaves on the surface of the ground: sometimes it is glutinous, and interspersed with fragments of wood, like the last. I confess I am exceedingly puzzled both with the contents and extent of this order; but this arises from my having seen so few of the species in the larva state. *Ptilophora plumigera*, figured by Mr. Curtis,[‡] I had always considered a *Notodonta*; but the larva evidently excludes it from the order, and, I should imagine, places it among the *Noctuæ*; where among them I know not, for I have not the slightest idea of any congeners, either of the larva

* It is a most singular chance that these genera should have been placed so naturally, as the cause of this proximity has never before been even hinted at.

† Another type of *Hepialus* is figured in Drury, Vol. II. pl. xiii. 2.

‡ British Entomology, pl. 328.

or imago. The larva from which a collector of *Lepidoptera* could expect to obtain such an imago would be unicolourous, stouter in the middle, elevated in the penultimate segment, and more attenuated towards the head.* *Pygæra* appears doubtful at first, but when observed quite at rest, and in a perfectly natural position, elevates the head and tail, though in a much less degree than the typical genus. Mr. Curtis's genus *Notodonta* contains several good species, which may be considered as typing the order, as *Ziczac*, *Tremula*, and *Dictæoides*. The first species, *Trepida* (the *Peridea serrata* of Mr. Stephens,) seems more nearly related to *Endromis*. Both these may, however, probably belong to the order *Notodontæ*, and be situate near the approach to the central order *Phalænæ*. *Petasia cassinea* and *Episema cæruleocephala* appear to be genuine *Noctuæ*, and very near *Chareas graminis*, and *Rusina ferruginea*, as far as my very imperfect knowledge of these four species will allow me to judge. *Clostera* is another departure from the type; but this may be accounted for, in some degree, by its close proximity to *Hepialus*, from which genus it borrows its remarkably short antennæ, and other peculiarities. It seems a strange perversion of judgment to place *Platypteryx* at the end of or among the *Geometræ*; but *Linnaeus* did so, and that is enough. *Hubner*, *Haworth*, and a few others, positively ventured, in this glaring instance, to refer this genus to the *Bombyces*; but their ideas were thought to be wrong, and their judgment was, *nem. con.* reversed. I have elsewhere expressed a wish that my readers should convince themselves, and the frequent occurrence of the larvæ of *Platypteryx* and *Cerura* would afford any naturalist abundant opportunity of ascertaining, that they can be referred to but one order. The approach of *Platypteryx* and *Cilix* to the *Pyalides*, in assuming so much of their characters, is very interesting, and is a most striking departure from the typical form. These genera also approach the *Lithosiæ*, but not so nearly as some exotics.

Natural Order—*Lithosiæ*. The difference between *Lithosiæ*

* As the larva so decidedly forbids the introduction of this insect among the *Notodontæ*, and places it among the *Noctuæ*, it probably in some degree approaches *Geometra pennaria* in the adjoining sub-class.

and *Arctiæ* is rather difficult to point out; yet a difference exists, which it is perfectly impossible not to detect. The larva of *Lithosiæ* has sixteen feet, is very active, is moderately hairy, does not readily roll itself in ring, but occasionally assumes that attitude. The pupa is smooth, changes in a slight web, in which the hairs are intermixed. The approach of *Lithosia** to the genus *Yponomeuta*, in *Tinea*, scarcely need be pointed out. It will be observed, that Mr. Samouelle† was aware of this approach, and placed the genera *Lithosia* and *Yponomeuta* following each other. The splendid *Callimorpha dominula*, although, to all appearance, a real *Arctia*, must be included in this order, and placed in contact with the following one.

Natural Order—*Arctiæ*. Larva, with sixteen feet, generally very hairy, bear-like; rolls itself in a ring when touched; pupa smooth, in a slight web. Whether the whole of Mr. Curtis's genus *Acronycta* must be included in this order, I am not able positively to say: the genus *Apatela* of Mr. Stephens certainly must, and until I have obtained sufficient information to decide on *Acronycta*, we must bring Mr. Stephens's genus only into the order, leaving the remainder of the species undisposed of. The development of the antlia in *Acronycta* discovers as near an approach to *Noctua*, as *Lithosia* does to *Tinea*; but the bear-like, cocoon-spinning larva place these insects in close alliance with the true *Arctiæ*.

Natural Order—*Lariæ*. Larva, with sixteen feet, and furnished with various brushes, or fascicles of hair, on different parts of the body, but mostly on the anterior dorsal segments; it rolls itself in a ring when touched. The genus *Porthesia* of Mr. Stephens may be considered a near approach to *Eriogaster*, in the following order, *Bombyces*, in many of its peculiarities, as the abdominal hair with which it covers its eggs, in its antennæ, &c. *Orgyia antiqua*, on the other hand, is in habit, expansion of wing, slender body, and apterous female, a close approach to the *Geometræ*, near the genera *Hybernia* and *Nyssia*; in fact, were it not for the larva, that is, were the larva unknown, we should have no hesitation about placing this insect with the *Geometræ*.

* See note for the genera of *Lithosia*.

† Ent. Useful Com. p. 249.

Natural Order—*Phalænæ*. Larva, with sixteen feet; it has a circle of wart-like protuberances on each segment, from each of which spring a few strong bristles; pupa, smooth, with a few bristles at the tail; changes in a cocoon, which is singularly left partly open at one end. We have but one species of this order in Britain, *Saturnia carpini*;* but among exotics there is a great variety, some remarkable for the immense expanse of their wings.† Probably *Phalæna Atlas* of Linnæus is the centre of the group, and, if so, the centre and type of the class *Lepidoptera*.

I have previously given, in a note, a list of the genera which are usually considered as *Bombyces*, and ought, therefore, if properly placed, to be included in the sub-class *Phalæna*; five of those genera yet remain, and at present must be excluded from the sub-class: *Penthophera*, *Heterogena*, and *Limacodes*, because I know nothing of their history; *Nudaria* and *Psyche*, because, in the larva, pupa, and imago states, they have the habit and appearance of another class (*Neuroptera*). The time of their dwelling with *Lepidoptera* is over and gone; they have already occupied too long a position to which they were not entitled. The difficulty of assigning a situation to *Limacodes* I hope to see removed, as the larva is occasionally to be met with. I must also remark, that although I have proposed a situation for *Endromis*, I feel very doubtful as to its being the correct one. These doubts and difficulties will probably gain me much censure; but I must endeavour to shelter myself in some degree, by observing, that I am the first who has ever deviated from the original Linnæan arrangement of *Lepidoptera*, the first who has ever thought of appealing to nature in support of theory, or rather has waited for nature to supply him with theory; and surely some allowance is to be made for a first attempt of any kind. I would also plead the poverty of our British Fauna in the sub-class, and my almost entire ignorance

* *Saturnia carpini* is the *Pavonia minor* of Linnæus, who, apparently, considered it a variety of a completely different species: the retention of a name thus originating in error is not justifiable.

† Drury has some fine figures of this order, particularly Vol. I. pl. xviii. 2; Vol. II. pl. v. 1, pl. vi. 2, pl. xi. 1, 2, pl. xiii. 2; Vol. III. pl. xix. pl. xxiv. pl. xxv. pl. xxxiv.

of exotic Phalænæ. Even supposing myself acquainted with all our indigenous species, they will barely furnish a systematist with a clew to the truth: you may pick up a single link of a chain, yet fail to discover the length of that chain, or the situation in that chain which the link originally possessed.

Having, then, pointed out, as clearly as my limited knowledge of the subject will permit, not only the principal contents of the class Lepidoptera, but endeavoured to establish them in appointed and fixed stations, and to show their mutual approaches, at least those of the most striking kind and essential to my purpose, I must now proceed to make a few remarks on the nature of these approaches. It will be observed, that they are, almost without an exception, what Mr. MacLeay considers relations of affinity, that is, the relation is between species which, in their imago state, have a real and positive similarity to each other; so much so, that entomologists, unacquainted with the prior states, and frequently even in direct defiance of their own knowledge of those states, place them in orders, and even sub-classes to which they do not belong; to which fact all our systems and catalogues bear most ample testimony. This similarity is by no means confined to a cursory glance at the insects, but bears the test of a minute anatomical investigation, the antlia, palpi and antennæ demonstrating the approach quite as forcibly as the form and appearance of the whole insect. Where a tribe has short biarticulate palpi, a genus departing from the type will assume elongated and triarticulate palpi, should another tribe with those characters approach it: again, should a tribe with long antlia approach a tribe whose character it is to have none, we shall be sure to find a genus without antlia at the point of approach. On the other hand, the very egg, the larva, the pupa, the mode of feeding and description of food, the mode of metamorphosis, and, in fact, every prior quality, or state, from which distinctions could be obtained, differ so decidedly, that the characters of these often bear as near an approach to those of Hymenoptera, Neuroptera, and even Coleoptera, as to those of their own kindred, into immediate contact with which these approaches will be found inevitably to bring them. What term can then be applied to designate the real value of this species of approach? Supposing

the terms analogy and affinity to have had good, sound, and distinct meanings, as originally employed and explained by great naturalists, they have now been so confused, confounded, and utterly misunderstood by ignorant persons, that either of these terms is entirely out of the question:* in fact, a suitable term by which to designate this peculiar species of relation or approach, I neither know where to find, or how to invent; and, therefore, I shall purpose simply to call it relation of larva, relation of pupa, or relation of imago, as the case may be.

In one instance, the relation of imago is, from several combining causes, which it will be unavailing to recapitulate, uncertain enough—that of *Barbicornis* and *Lasiocampa*; but I would ask the impartial reader, is it half so far-fetched and untenable as those in common use? Can human sagacity, in sheer wantonness, invent combinations more unnatural than ———, twenty or thirty of which we could all point to in our own cabinets? For the value of the other relations (eleven others) I appeal to the judgment of the assiduous collector, the experienced observer, the real nature-loving naturalist,—to him who has spent days in the woods, and not only captured but observed these delightful beings,—to him who never invented or supported a theory,—to him who is pledged to no system, to no party,—I ask him, nothing doubting of his concurrence, whether these relations do not too plainly bear the impression of nature's seal, to allow him to doubt one instant of their reality.

In the next place a question occurs, how is the relative position of the sub-classes proved to be correct, seeing it is so totally at variance with what we have from our childhood been perfectly

* No individual need say with more 'heartfelt sincerity—"Preserve me from my friends," than Mr. MacLeay; let the naturalist read the *Horæ Entomologicæ*, and he will pause in admiration at the vigorous, manly display of intellect, which, frankly and eagerly seeking truth, throws a golden lustre over every page; and, I confess, my eyes were opened to the suspicion that all was not pure gold, by the awkward and abortive attempts of commentators to prove it so. Puerile schemes of applying the quinary system in detail, and sundry vapourings about affinity and analogy, have so mystified these subjects, that they already totter to their very foundations, and must speedily fall; while the existence of circles must stand for ever as a discovery of which Britain is proud.

satisfied with?*

It is proved correct, simply and solely by the harmony with which each flows into each,—with which neighbour meets neighbour,—comparable somewhat to that exquisite feeling which induces a man to bend to the peculiarities, and perhaps even little failings of a friend, until he makes them almost his own. It can hardly be supposed that the sub-classes naturally fell into the positions which I have assigned to them, without some little endeavour, on my part, to produce this harmony. This was far from the case. The discovery, if it be one, was the result of serious and deliberate study. Even after arriving at their present state, I have twice endeavoured to alter these positions, once in hopes of making some of the Tortrices meet the Papilionidæ, as I had an idea that that very assiduous and ingenious naturalist, Dr. Horsfield, had mentioned the discovery of such an approach.† In vain, however, did I strive to discover such an approach, in either larva, pupa, or imago, while these points of resemblance were most abundant between the Geometræ and Papiliones; the pupa, as though in sport, being now suspended by the tail, now girted round the waist, now enveloped in a silken web; sometimes round-headed, sometimes pointed, sometimes eared; now smooth, anon angulated, black, brown, yellow, pure green, clouded, or spotted: of these, and a thousand other peculiarities, which tended to corroborate my ideas of arrangement, I refused invariably to avail myself, trusting to one guide only, which seems as steadfast as a rock: that *relation of imago constitutes approach of divisions; relation of larva is the tie which holds divisions together*. The second alteration I endeavoured to make, was to place the Papiliones in the centre, a situation to which their splendour and magnitude would really appear to give them a title. This idea seems every way so plausible, and so likely to be proposed by entomologists, should any such see merit enough in this system to give their attention to its minutiae, that I am compelled to consider it more at large.

To a sub-class selected for a centre, two qualities are indispensably requisite. They have been previously given from

* This question has occurred.

† It is so long since I have seen Dr. Horsfield's beautiful work, that I will not pledge myself to the doctor's making this assertion.

Mr. MacLeay, who, it will be remembered, discovered that one of each of his five groups contained types of the other four, besides a type peculiar to itself. This quality must hold good in any group thus selected for a centre; it must contain types of the six surrounding groups in the first place. Now, is this applicable to *Papilio*? Have we not already experienced the greatest difficulty in finding three good approaches, the smallest number which a sub-class can possess? How then can we hope, by any good fortune in discovery, to make ourselves masters of three other entirely new ones, and these to sub-classes to which it is confessedly the most unlike? *Phalæna*, on the contrary, presents us with *Lasiocampa*, *Ægeria*, *Cilix*, *Lithosia*, *Apatela* and *Orgyia*, five of which genera beautifully typify the approximating sub-classes. The preference on this score then is decidedly with *Phalæna*.

The second position, that it should contain a type peculiar to itself, is almost a matter of course; but my own idea is, that the very centre should not only be a type of the genus, or order, or sub-class, but of the class itself of which it is the centre. From this position, then, a further and still more important question arises,—What is the type of *Lepidoptera*? The parts which afford the generic characters of *Lepidoptera*, and, I believe, generic characters in the perfect state are the only ones of any value, are these—the mouth, palpi, antennæ and wings; and, as no medium can constitute a type, the excess of these characters, whether superlatively or diminutively considered, must be resorted to as the most probable means we possess of discovering what this type may really be. First, then, the mouth. In *Lepidoptera*, we find two distinct characters in this;—first, its entire absence; secondly, its being furnished with prodigiously long antlia. The first character is that of *Phalæna*, the second that of *Sphinx*. Next, the palpi are either entirely obsolete or exceedingly prominent, the first in *Phalæna*, the second in *Pyralis*. Thirdly, the antennæ are remarkably pectinated, or clavated, or setaceous: the first character is that of *Phalæna*, the second that of *Papilio*, the third that of *Noctua*. Fourthly, the wings are enormously expansive in proportion to the body, or remarkably small,—the first is the character of *Phalæna*, the second that of *Sphinx*.

It need scarcely be added, that all these characters are to be met with in every intermediate degree of intensity. Now, it appears, that *Phalæna* possesses an extreme of each of the four principal characters, *Sphinx* of two, *Noctua* of one, and *Papilio* of one; therefore *Phalæna* is the typical genus, *Phalænæ* the typical order, and *Phalæna* the typical sub-class of *Lepidoptera*: and a necessary conclusion from this fact is, the type of *Lepidoptera* is an insect without antlia or palpi, with very pectinated antennæ and enormously expansive wings, and we may add nocturnal flight: so that such peculiar characters as the thick full body and prodigiously long antlia of *Sphinx*, the clavate antennæ, erect wings, and diurnal flight of *Papilio*, argue a departure from, and not an approach to, the type.

By a reference to the Diagrams exhibiting the classes of *Insecta*, and the sub-classes of *Lepidoptera*, it will at once be observed, that the central group in each case contains types of the surrounding groups. Now after a central group has thrown off a set of six forms, each representing, in general appearance, some group equally extensive with such central group, the faculty or power of throwing off such forms becomes, in a good degree, extinct, or, at any rate, very much debilitated. This can be no unforeseen, but a perfectly natural, and absolutely necessary consequence; for taking either of the two classes which are at present sought after, *Lepidoptera* and *Coleoptera*, we must observe, that did either of them possess as varied forms and characters as are to be found in *Neuroptera*, the essential and distinguishing character of that class, viz. variety, and the harmonious arrangement of the whole sub-kingdom, would both be entirely lost; and it would remain for human ingenuity to locate either of the classes centrally or externally, as caprice, or the love of differing from others, might dictate. I wish it to be observed, that *Neuroptera*, in the genera *Psyche*, *Cloëon*, *Termes*, *Psocus* and *Mantispa*, does not merely assume the form of the genera, *Tinea*, *Chironomus*, *Formica*, *Aphis* and *Mantis*, but actually possesses the characters and appearance of the classes *Lepidoptera*, *Diptera*, *Hymenoptera*, *Hemiptera* and *Orthoptera*. The obviously homogeneous character of *Lepidoptera* and *Coleoptera*, although, probably, containing in every sub-class more

species than the whole of Neuroptera, clearly disproves the existence of variety amongst their contents, equal to that amongst the contents of Neuroptera. Yet the power, although weakened, is by no means extinct; for, amongst the central group, Phalæna, we find the sub-classes, Papilio, Sphinx, Pyralis, Tinea, Noctua and Geometra, most faithfully portrayed in Lasiocampa, Ægeria, Cilix, Lithosia, Apatela and Orgyia, and not merely the individual genera which may happen to approach. As far as I can discover, after this second series of types the faculty becomes much weaker, and, after a third, ceases entirely. A decided difference existing between the first and second series of types, must on no account be lost sight of, because it so decidedly proclaims the superiority of the first: in the first instance, the whole character of the central type, Libellula, is completely lost in each of the varying types; whereas, in the second instance, the characters of Phalæna are preserved most decidedly to the remotest ramifications of the class, subject, however, to the variations already pointed out.

The natural order, *Cossi*, of which the larva and pupa have been already described, contains but ten genera, even including those whose claim to a place in the order is somewhat doubtful; and these ten are readily referable to six families. The genus, Stygia, of New Holland, seems from Latreille's description, decidedly to belong to this order. Speaking of Stygia Australis, he says, "*M. Villiers la considère comme intermédiaire entre les Sesies et les Zygènes; mais elle n'a point de trompe; ses palpes sont ceux de Cossus; ses antennes sont courtes, et nullement en fuse, et plus analogues à celles de certains Bombyx qu'à celles des Sesies et des Zygènes.*"* Now the fact, as M. Latreille supposes, of having no antlia, argues most forcibly the impossibility of uniting this genus either with Sphinx or Zygæna; for the sub-class Sphinx not only possesses the most elongate and conspicuous antlia of any sub-class, but retains this character to its very circumference, and imparts it to approaching groups, whose types will be found entirely aglossate: its similarity therefore in shape to the Sesiæ, which tribe is generally understood to

* Règne Animal, tom. V. p. 395.

include the *Ægeriæ*, is merely that relation of imago which I have before so repeatedly pointed out. The situation, which without this genus must have been vacant, thus filled, gives us a most perfect chain of families throughout the order, except at the point of connexion with *Phalæna*, a point of no consequence, because it too much favours old theories to be contested.

It is rather remarkable, that in this order no instance should occur of more than three genera belonging to any one family, a number which I should hardly suppose complete, because a difficulty must always occur in placing, as in discovering the typical genus or species, where the number is confined to three.

The introduction of a new generic name, after what has been said on that subject, may appear rather an inconsistency, but I found it indispensable, as the species in question would not bend to either of the established genera, *Trochilium* or *Ægeria*; it will, moreover, afford those whose labours in this way I have somewhat deprecated, a fair opportunity for retaliation. The families and their relative situations, as far as my immature and hastily-formed judgment will allow me to decide, I have shown in the annexed diagram: but it is now time for me to describe the species whose situation I am endeavouring to point out.

Sub-kingdom, INSECTA.

Characters from the imago.

The body is divided into three parts, head, thorax, and abdomen; the head has two fixed compound eyes, and two moveable antennæ. Insects have six jointed legs in pairs; they breathe by lateral spiracles.

Class, LEPIDOPTERA.

Characters from larva, pupa, and imago.

Larva polypod, bears no resemblance to the imago; pupa quiescent, bears no resemblance to the imago. Imago has four scaly wings, and the mouth aglossate or antliate.

Sub-class, PHALÆNÆ (central).

Characters from larva, pupa, and imago.

All varying (the universal character of such central groups).

Natural order, COSSI.

Characters from the larva and pupa.

Larva depressed, kaned; has sixteen feet, lives through one or

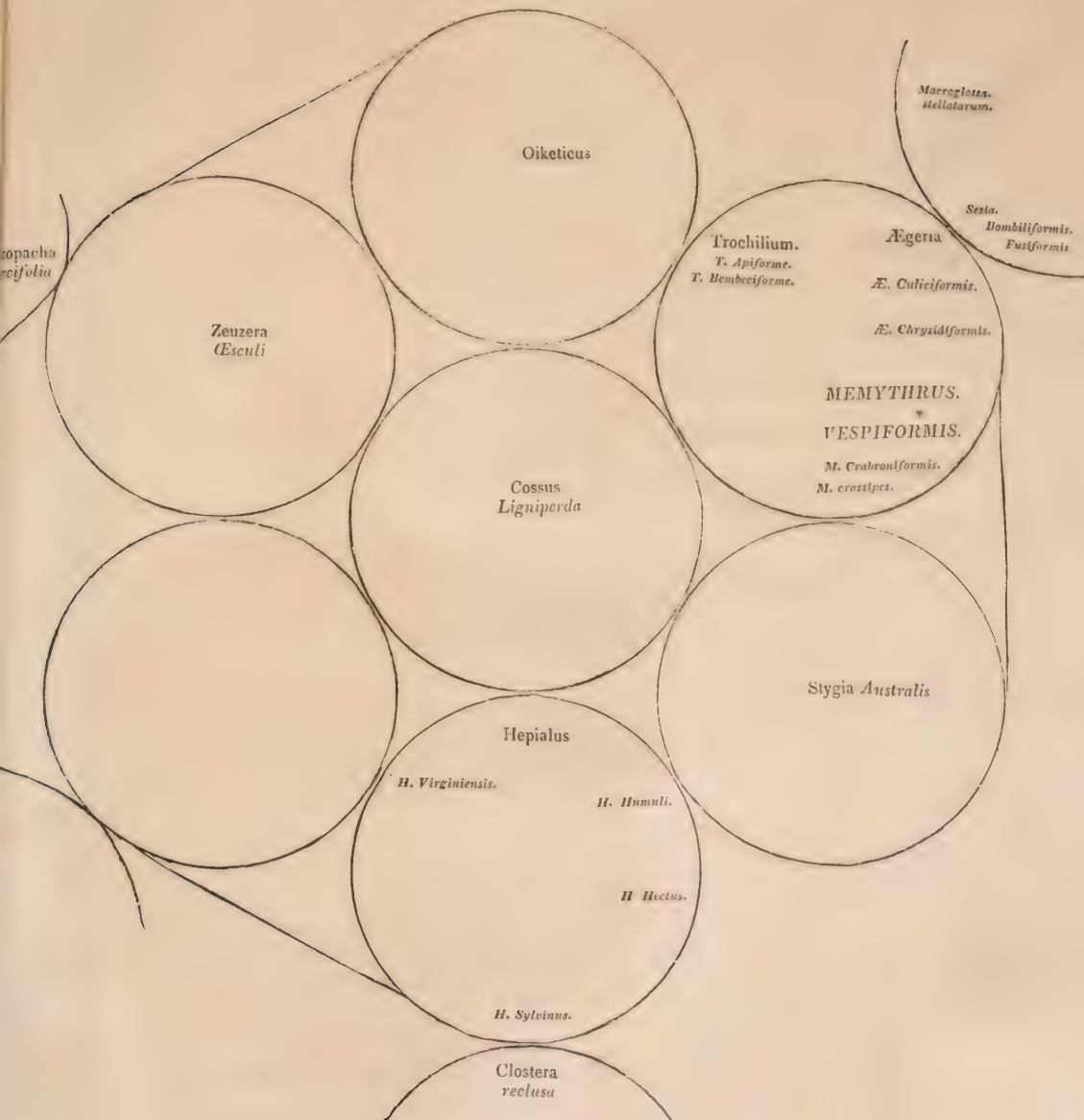
GENERA OF THE

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GENERA OF THE NATURAL ORDER COSSI.



more winters, never rolls itself in a ring when touched, feeds on the solid interior woody parts of vegetables; pupa changes in a tough cocoon, in which are interwoven particles of the larva's food; it has a double row of small raised denticulations on each segment of the abdomen, which give it partially the power of locomotion.

Family ÆGERIIDÆ, Stephens.

Characters from the Imago.

Palpi triarticulate, incrassated at the base, acuminate at the apex, prominent, enclosing the antlia; antennæ, sub-cylindric, gradually incrassated from the base nearly to the apex, the apex itself acuminate and terminated with a fascicle of hairs; ocelli, two. Flight diurnal in the hottest sunshine.

Genus MEMYTHRUS.—*Sphinx*, Linn.; *Sesia*, Laspeyres; *Egeria*, Fab.

Characters from the imago.

Palpi very prominent, and densely clothed with scales at the base, in appearance angulated; antlia fine, not so long as the antennæ; antennæ the length of the thorax, in the male much pectinated, in the female simple; superior wings clothed with scales, inferior hyaline.

Sp. 1. MEMYTHRUS VESPIFORMIS.—*Sphinx Vespiformis*, Linn. Syst. Nat. II. p. 804, n. 31. *Egeria Asiliformis* of Fabricius, and other authors.

Characters from the imago.

Palpi black, yellow at the apex; antennæ black, beneath testaceous; fulvous at the base; head black, excepting a white mark before each eye; a yellow ring round the neck; thorax black, with a yellow spot at the base of each superior wing; abdomen black, slightly barbate, with three equidistant yellow belts; superior wings deep fuscous, inferior hyaline; femora and anterior tibiæ black, posterior tibiæ and all the tarsi yellow.

Inhabits England, but is very rare.

Sp. 2. MEMYTHRUS CRABRONIFORMIS.—*Sesia crabroniformis*, Lasp.

Inhabits Italy.

Sp. 3. MEMYTHRUS CRASSIPES.—*Sphinx crassipes*, Drury.

Inhabits Africa.

Sp. 4. MEMYTHRUS TIBIALIS.—*Ægeria tibialis*, Fab.

Sp. 5. MEMYTHRUS ————?—Unnamed in the Linnæan cabinet.

Several other species probably exist, with which I have not happened to meet.

The principal distinctions between Memythrus and *Ægeria* are, that the antennæ in the former are not longer than the thorax; in the latter they are much longer; in the males of the former genus they are decidedly pectinated, in those of the latter but obscurely ciliated; in the former the anterior wings are always opaque, in the latter always hyaline.

*Natural Divisions to which the SPHINX VESPIFORMIS of
Linnæus is referable.*

FIRST PRIMARY GROUP	ANIMALIA.
FIRST KINGDOM	ANNULOSA.
CENTRAL SUB-KINGDOM	INSECTA.
FIRST CLASS	LEPIDOPTERA.
CENTRAL SUB-CLASS	PHALÆNA.
SECOND NATURAL ORDER	COSSI.
SECOND FAMILY	ÆGERIIDÆ.
SECOND GENUS	MEMYTHRUS.
FIRST SPECIES	VESPIFORMIS.

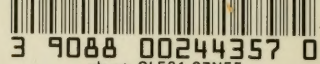
FINIS.

DIRECTIONS FOR PLACING THE DIAGRAMS.

1. The Classes of Insecta to face page 21.
2. The Sub-classes of Lepidoptera to face page 31.
3. The Natural Order of Cossi to face page 52.







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Sphinx vespiformis :